Exhibit 11

Human Machine Interaction

Research Results of the MMI Program

2009

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Human Machine Interaction, or more commonly Human Computer Interaction, is the study of interaction between people and computers. It is an interdisciplinary field, connecting computer science with many other disciplines such as psychology, sociology and the arts.

The present volume documents the results of the MMI research program on Human Machine Interaction involving 8 projects (selected from a total of 80 proposals) funded by the Hasler Foundation between 2005 and 2008.

These projects were also partially funded by the associated universities and other third parties such as the Swiss National Science Foundation.

This state-of-the-art survey begins with three chapters giving overviews of the domains of multimodal user interfaces, interactive visualization, and mixed reality. These are followed by eight chapters presenting the results of the projects, grouped according to the three aforementioned themes.

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Common terms and phrases

6th Sense abstract ACM action algorithm androids application approach architecture ARV augmented reality camera cognitive colour communication complex components Computer context database defined detection developed devices dialog display domain E2E Adaptation elements emotions encoding parameters engine environment evaluation example Fig Figure framework fusion gestures glyphs graphical user interface

More terms and phrases

objects. It presents example applications and outlines limitations and solutions for their technical implementation.

MR was derived both conceptually and historically from Virtual Reality (VR). VR systems are computer systems in which users are immersed in a virtual, computer-generated world. The very first examples were originally developed in the 1960s [2]. Immersion is generally achieved through visual, auditory, and sometimes tactile displays. All these displays isolate users from their familiar surroundings, giving the illusion that the only objects existing around them are those rendered by the computer. In MR systems, users perceive both the physical environment around them and digital elements presented through, for example, the use of semitransparent displays. Imagine a system that indicates the name and provenance of items around you by displaying virtual labels overlaying the objects, or a system that guides your way by showing virtual arrows, or a system that displays people's names and affiliations on virtual badges. The information could be displayed in the native language of each user or could be customized to be most relevant to their individual profile; for example, when browsing food products, specific information could be provided according to the user's allergies.

MR systems are designed to give their users the illusion that digital objects are in the same space as physical ones (Figure 1). For this illusion of coexistence, the digital objects need to be precisely positioned into the real environment and aligned with the real objects in real time [3]. In fact, the precise real-time alignment or registration of virtual and real elements is a definitive characteristic of augmented reality systems [3], and it constitutes a difficult technical challenge for its realization. Augmented reality is often considered to be a branch of MR. According to the definition of Milgram et al. [4], MR is "subclass of VR related technologies that involve merging of real and virtual worlds". MR includes systems in which the virtual aspects are dominant as well as those in which the physical reality is dominant. Within this range, augmented reality has more physical elements than virtual elements.

Fig. 1. The BUILD-IT system, an example of a collaborative tabletop MR application

State-of-the-Art Survey

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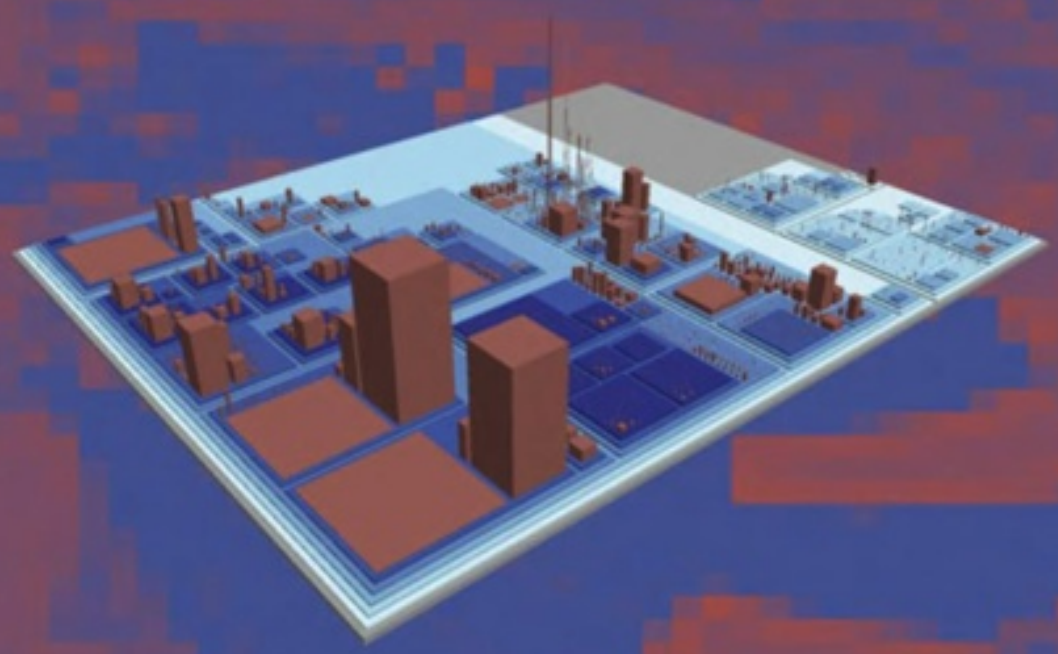

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